LOUISIANA ENERGY POLICY SIMULATOR INSIGHTS: CURRENT EMISSIONS TRAJECTORY, NDC SCENARIO

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OVERVIEW

Louisiana is on the front lines of the climate crisis, experiencing some of the country's most extreme weather impacts while also having one of the largest greenhouse gas (GHG) footprints of any state.[iii] In August 2020, Governor John Bel Edwards announced the state's ambition to achieve widespread emissions reductions and committed to preventing the worst impacts of climate change. Louisiana set ambitious climate targets to reduce net GHG emissions 26 percent to 28 percent below 2005 levels by 2025; to further reduce emissions 40 percent to 50 percent by 2030; and to achieve net-zero emissions by 2050.[1]

The Louisiana Energy Policy Simulator (EPS) modeling tool, developed by Energy Innovation (EI) and RMI, estimates the impact of climate policies on net GHG emissions and on other

[i] Energy Innovation: Policy and Technology LLC, https://energyinnovation.org.
[ii] RMI, RMI.org.
[iii] Louisiana has the country's seventh-largest energy-related emissions, according to the U.S. Energy Information Administration (EIA). https://www.eia.gov/environment/emissions/state/.

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important considerations such as job creation and public health outcomes. In this way, the tool can support Louisiana policymakers in achieving the state's climate goals.

In the BAU Scenario, Louisiana's modeled economy-wide emissions increase 30 percent by 2050 compared to 2020.[iv] This includes projected growth in demand for energy and services but does not specifically include the significant number of proposed industrial facilities in Louisiana. The NDC Scenario shows that a policy package aligned with nationwide action to meet the United States' targets under the Paris Agreement could reduce statewide emissions 97 percent below 2020 levels by 2050, and would produce positive economic and health impacts.

The NDC Scenario policies would generate an estimated 111,000 new job-years in 2030 and 263,000 new job-years in 2050,[v] while emissions reductions in the NDC Scenario would avoid approximately 2,300 premature deaths per year by 2050. The NDC Scenario includes emerging technologies, like hydrogen electrolysis and CCS, that have yet to be commercialized or are not yet widely deployed. Additional innovation on these emerging technologies will be necessary to achieve the emissions reductions modeled in the scenario. Uncertainty does exist regarding when and how these technologies will be available at the scale and cost necessary to achieve the modeled industrial emissions reductions by 2050.

The Louisiana EPS will be used by Louisiana's Climate Initiatives Task Force (CITF), which is developing a set of strategies and actions to meet Louisiana's GHG reduction goals and other fundamental objectives for its people, economy, and environment. The CITF will use the Louisiana EPS to model the emissions impact of proposed strategies and actions, using Louisiana-specific implementation timelines and policy design. The CITF policies can be compared against the BAU and NDC Scenarios to benchmark outcomes and identify potential adjustments that could increase the likelihood of achieving the state's emissions reduction goals. The Louisiana EPS can be used by anyone to simulate the potential outcomes of policies that could help reduce GHG emissions.

THE LOUISIANA ENERGY POLICY SIMULATOR

The Louisiana EPS is a free, open-source, peer-reviewed model that allows users to estimate climate and energy policy impacts on emissions, the economy, and public health using publicly available data. The model estimates these impacts through 2050 and accounts for how policies interact with each other. EPS models have been developed for more than a dozen countries and

[iv] This is due to forecasted increases in energy consumption in the industrial sector, modeled using forecasts from EIA's 2021 Annual Energy Outlook: https://www.eia.gov/outlooks/aeo/.

[v] A job-year is defined as one year of work for one person. For instance, a new construction job that lasts five years is equal to five job-years. This is a more accurate measure than "job" because one job may last for five months or five years.

several subnational regions, including California, Colorado, Minnesota, Nevada, and Virginia. EPS models now cover 56 percent of global GHG emissions. The Louisiana EPS is one of many state-level EPS models that EI and RMI are developing. A companion document explains key EPS data sources, assumptions, and calculation methodologies.

The Louisiana EPS does not replace more granular analytical approaches such as energy demand infrastructure turnover and energy supply optimization,[vi] electricity system reliability analysis,[vii] detailed assessments of electricity and natural gas utility and customer economics,[viii] analyses of local air quality,[ix] and mapping policy effects on equity.[x] But the Louisiana EPS complements those approaches and can calculate impacts in seconds in an accessible web-based interface, which can help policymakers and the public to rapidly screen policies and understand remaining emissions gaps.

As with any tool, the EPS carries uncertainties, including the precise impacts of a given policy. Additionally, some policies included in the EPS rely on new and developing technologies, particularly in the industry sector. For example, green hydrogen and carbon capture utilization and storage have yet to be deployed at scale. To accommodate regional variation and uncertainty, the tool is designed to be flexible, data-driven, and thoroughly documented. The model also does not make determinations about the likelihood of implementation.

LOUISIANA'S BUSINESS AS USUAL EMISSIONS OUTLOOK

The BAU Scenario includes existing policy, scheduled power plant retirements, building and transportation efficiency improvements, and economic adoption of electric vehicles (EVs). Industrial expansions and new facilities under consideration could add up to 100 million metric tons of carbon dioxide equivalent (MMT CO_2e), but because of the uncertain timing, size, and scale of those projects, these emissions are not included in our BAU Scenario.[xi]

Industry is the largest source of emissions in Louisiana, accounting for more than 60 percent of total emissions in the Louisiana EPS in 2020.[xii] The industrial sector covers energy production,

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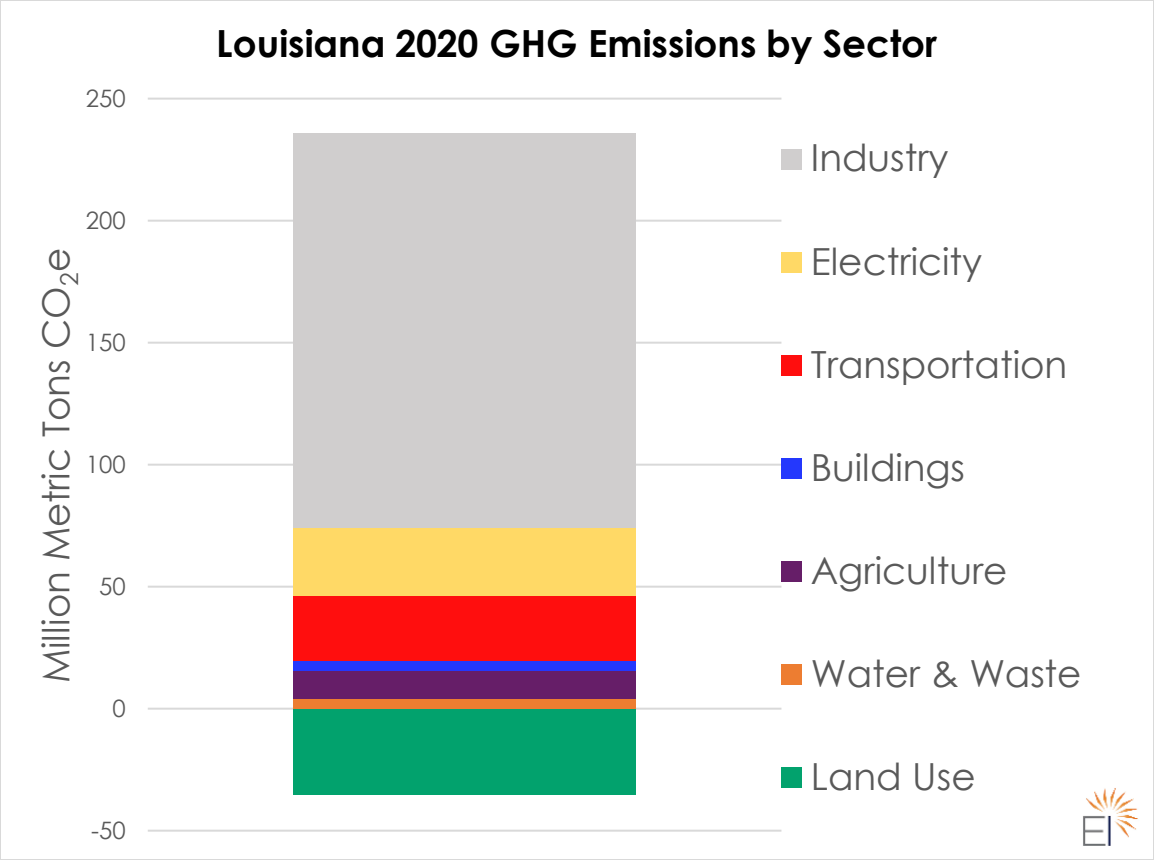
[vi] See, e.g., https://www.unsdsn.org/Zero-Carbon-Action-Plan.
[vii] See, e.g., https://www.2035report.com/wp-content/uploads/2020/06/2035-Report.pdf.
[viii] See, e.g., https://ww2.energy.ca.gov/2019publications/CEC-500-2019-055/CEC-500-2019-055-F.pdf.
[ix] See, e.g., https://ww2.energy.ca.gov/2019publications/CEC-500-2019-049/CEC-500-2019-049.pdf.
[x] See, e.g., https://oehha.ca.gov/media/downloads/calenviroscreen/report/ces3report.pdf.
[xi] Permitted facilities were not included in the BAU forecast because it is not certain they will all be built. Data on permitted facilities from: https://environmentalintegrity.org/download/eip-emissions-increase-database/.
[xii] See the "Emissions CO_2e: by Sector Graph" in the Louisiana EPS, available here: https://louisiana.energypolicy.solutions/.

manufacturing, and construction, and includes both fossil fuel consumption and industrial process emissions. Within the industrial sector, the chemicals, refined petroleum, and oil and gas industries account for 85 percent of emissions. Electricity and transportation each generate about 11 percent of the state's emissions. Buildings, water and waste, and agriculture each represent less than 5 percent of emissions.

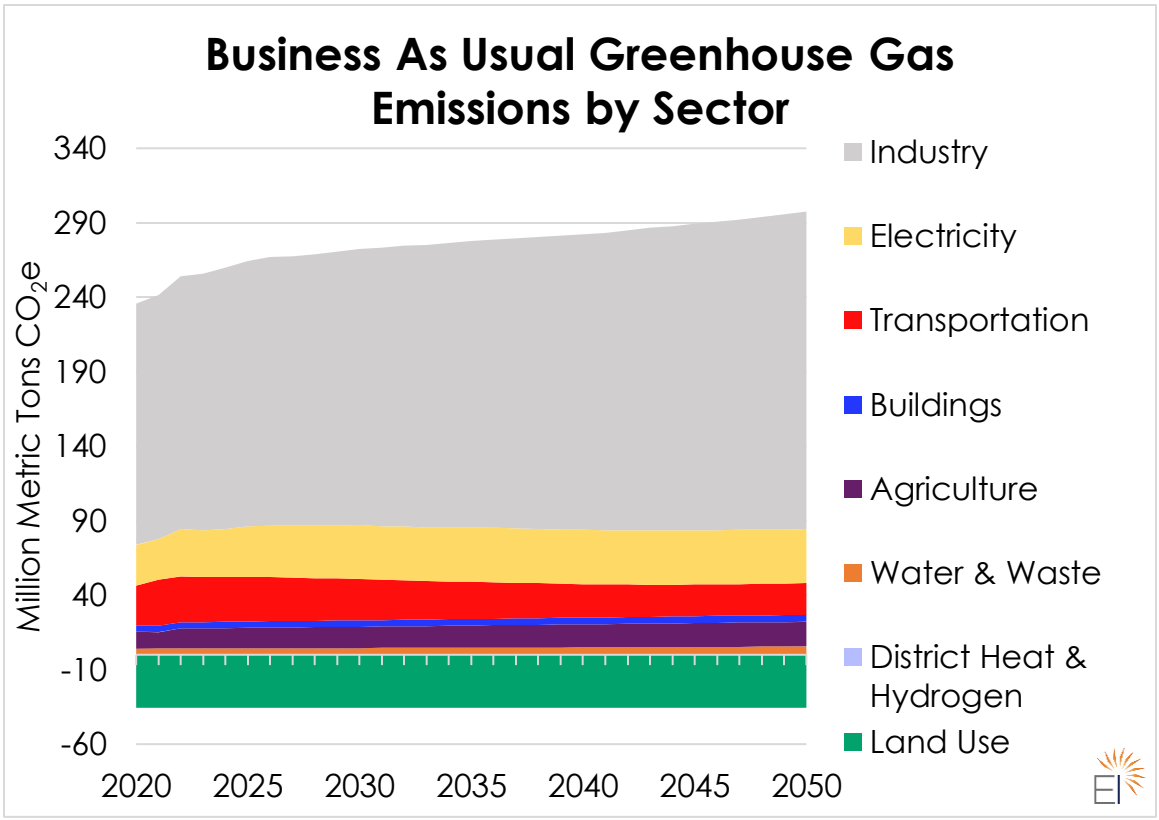


Louisiana's estimated 2020 GHG emissions in the Louisiana EPS

Louisiana's economy-wide emissions are expected to increase 30 percent from 2020 to 2050 under the BAU Scenario. The growth in emissions is primarily driven by a forecasted increase in energy use and services.[xiii] While modeled growth includes some new industrial fuel demand, the BAU

[xiii] This is due to forecasted increases in energy consumption in the industrial sector, modeled using forecasts from EIA's 2021 Annual Energy Outlook: https://www.eia.gov/outlooks/aeo/.

Scenario does not specifically include the significant number of proposed new chemical, refining, and oil and gas transport facilities in Louisiana, which could add up to 100 MMT CO_2e on top of the BAU scenario in the next decade.[xiv]



Projected GHG emissions by sector in the Louisiana EPS

THE GAP TO NDC COMPLIANCE

Louisiana ranks seventh in the U.S. for GHG emissions because a large portion of the country's chemical manufacturing, refining, and oil and gas production is located in the state. Reducing Louisiana's emissions is expected to be challenging because the state's economy is intertwined with these industries. Emissions reductions also present an opportunity for Louisiana to transition

[xiv] Permitted facilities were not included in the BAU forecast because it is not certain they will all be built. Data on permitted facilities from: https://environmentalintegrity.org/download/eip-emissions-increase-database/.

to clean industrial practices and generate plentiful jobs in the process. In addition, several of the simulated policies have a net-negative cost—meaning fuel cost savings over the lifetime of the policy offset the up-front capital costs[xv]—including a clean electricity standard, an EV sales standard, and industry efficiency standards.

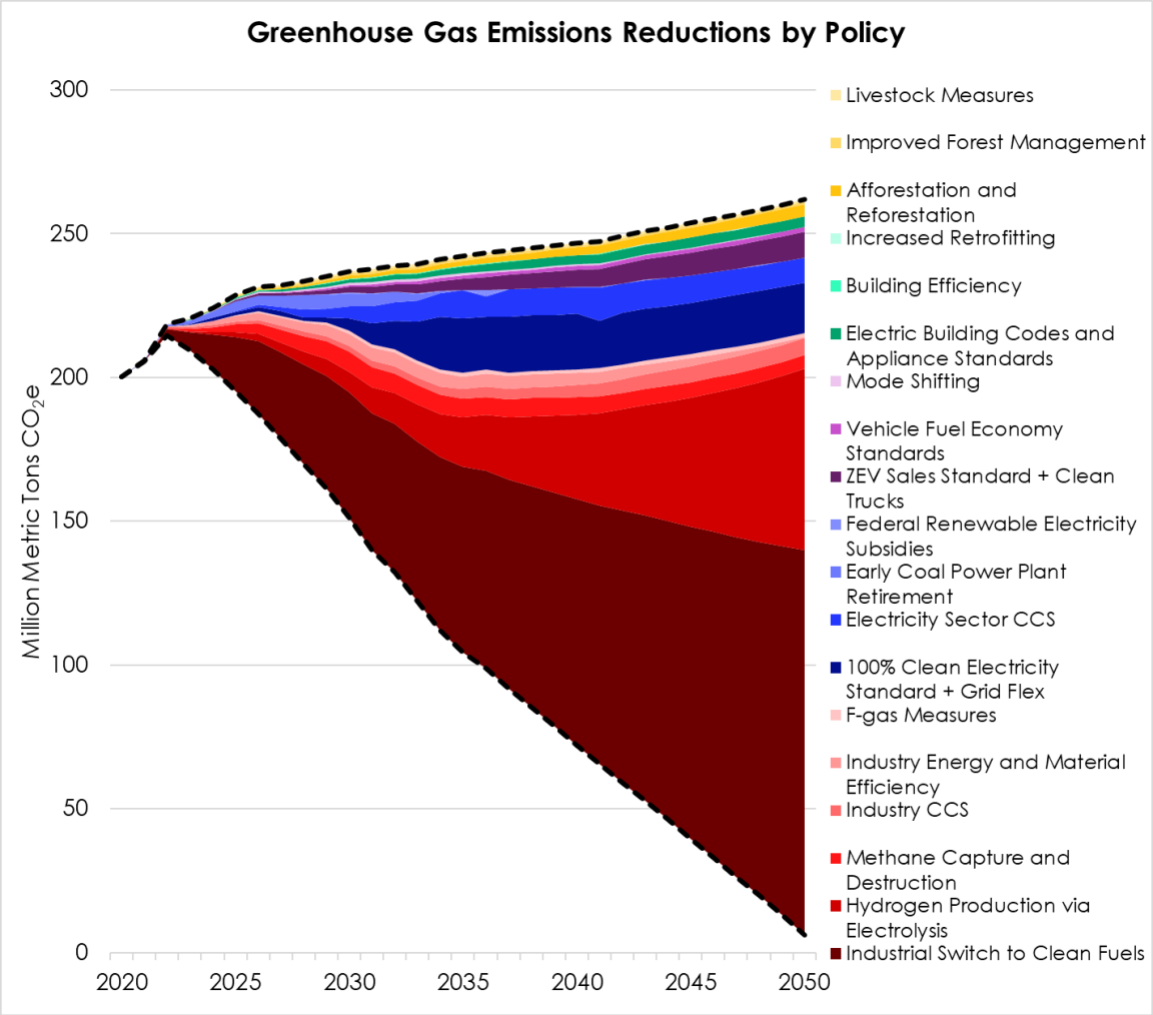
POLICY OPTIONS FOR DEEP DECARBONIZATION

The Louisiana EPS includes an NDC Scenario demonstrating a path to meet GHG emissions reduction goals aligned with global efforts to limit climate change to no more than 1.5 degree Celsius. This illustrative policy scenario is adapted from a nationwide scenario developed by EI[2] and shows one set of policies that achieve 97 percent economy-wide emissions reductions by 2050.

The NDC Scenario included in the Louisiana EPS tool does not quite reach net-zero emissions by 2050, leaving Louisiana with 5 MMT CO_2e by 2050 (equivalent to about 3 percent of 2020 BAU emissions). This is due, in part, to uncertainty about future available technology to mitigate industrial emissions and continued global demand for fossil fuels.

As technology develops in the coming decades or if global demand for fossil fuels decreases significantly, it may become easier for Louisiana to achieve net-zero emissions. Alternatively, the state may be able to offset emissions through wetlands management or other land management, beyond what is already included in the NDC Scenario.

[xv] See the marginal abatement cost curve in the NDC Scenario, https://louisiana.energypolicy.solutions/.



Note: This wedge chart aggregates some policy levers to improve figure readability; a full interactive wedge graph is available on the Louisiana EPS

INDUSTRY, AGRICULTURE, AND LAND

To reduce energy-related emissions in industry, the NDC Scenario includes industrial facilities electrifying (switching from using fossil fuels for boilers and equipment to using electricity) all end-uses where possible and switching to zero-carbon fuel (in this case, hydrogen) for all others by 2050. The scenario also includes hydrogen production through a zero-carbon process known as electrolysis. Policies promoting more efficient use of industrial materials and improved industrial energy efficiency achieve additional reductions.

The NDC Scenario includes several policies to address non-energy industrial emissions, including standards for mitigating methane leakage in the oil and gas sector. Appliance manufacturers are required to switch to refrigerants with low global warming potential consistent with the Kigali Amendment to the Montreal Protocol.[xvi] The NDC Scenario also includes carbon capture and sequestration to capture half of remaining carbon dioxide process emissions from the industrial sector.

The NDC Scenario includes emerging technologies, like hydrogen electrolysis and CCS, that have yet to be commercialized or are not yet widely deployed, and additional innovation will be necessary on these emerging technologies to achieve the emissions reductions modeled in the NDC Scenario. Hydrogen electrolysis is likely necessary for industrial fuel switching—the policy responsible for most emissions reductions in the NDC Scenario. Uncertainty does exist regarding when and how these technologies will be available at the scale and cost necessary to achieve the modeled industrial emissions reductions by 2050.

Finally, implementing land management policies such as reforestation and improved forest management reduces land-use emissions.

ELECTRICITY

Rapidly replacing fossil fuel generation with clean electricity is foundational for reducing emissions in other sectors. Transitioning electricity capacity to zero-carbon sources enables EVs, electric building appliances, and electric industrial equipment to run with zero or near-zero upstream emissions. The NDC Scenario implements a clean electricity standard of 80 percent carbon-free electricity generation in 2030 and 100 percent in 2035 and beyond. Other infrastructure investments include adding 10,500 megawatts (MW) battery storage, doubling transmission capacity, and adding 5,000 MW of demand response capacity.[xvii]

TRANSPORTATION

Decarbonizing on-road transportation accounts for approximately 4 percent of the emissions reductions in the NDC Scenario. The NDC Scenario includes an EV sales standard requiring all new passenger cars and SUVs sold to be electric by 2035 and all new freight trucks to be electric by 2045.

[xvi] This is now required by EPA via the AIM Act. See, https://www.epa.gov/climate-hfcs-reduction.

[xvii] Eliminating the last 10 percent of fossil generation and maintaining reliability in a zero-carbon grid is the subject of ongoing research. In the NDC Scenario, gas generators run at low and declining capacity factors to provide reliability, and in the 2040s these are modeled as being equipped with carbon capture and sequestration. Use of other decarbonized fuels could be possible, such as biogas or renewable hydrogen.

The NDC Scenario also includes investing in passenger car travel alternatives with supportive land use and transportation policies that enable people to use public transit and to walk and bike, reducing passenger car vehicle miles traveled 20 percent by 2050. Such measures can be designed to provide economic and social benefits such as enhanced access to transportation and affordable housing[3] and could yield climate benefits beyond the direct emissions reductions modeled in the Louisiana EPS. For example, compact development and reduced car dependence lower embodied emissions for vehicles and buildings, building energy consumption, and conversion of natural lands.[xviii]

BUILDINGS

The NDC Scenario includes building electrification and energy efficiency measures. A sales standard would require newly sold building equipment to be fully electric by 2030 in both new and existing buildings and would shift gas space and water heating systems to more efficient all-electric heat pumps, which are already commercially available and common in many parts of the U.S.[4] Induction stoves provide a high-performing and clean alternative to gas stoves while also avoiding indoor air pollution.[5]

In addition, the NDC Scenario includes deep energy efficiency retrofits for 15 percent of buildings by 2050.[xix] Enhanced efficiency standards for individual building appliances are also included, ranging from 11 percent to 40 percent by end use.

AGGREGATE EMISSIONS IMPACTS

The Louisiana EPS estimates economy-wide emissions reductions considering interactions between policies in each scenario. It also automatically estimates the contributions to emissions reductions from each individual policy measure. The greenhouse gas emissions reduction by wedge chart summarizes GHG emissions avoided in the NDC Scenario relative to BAU.

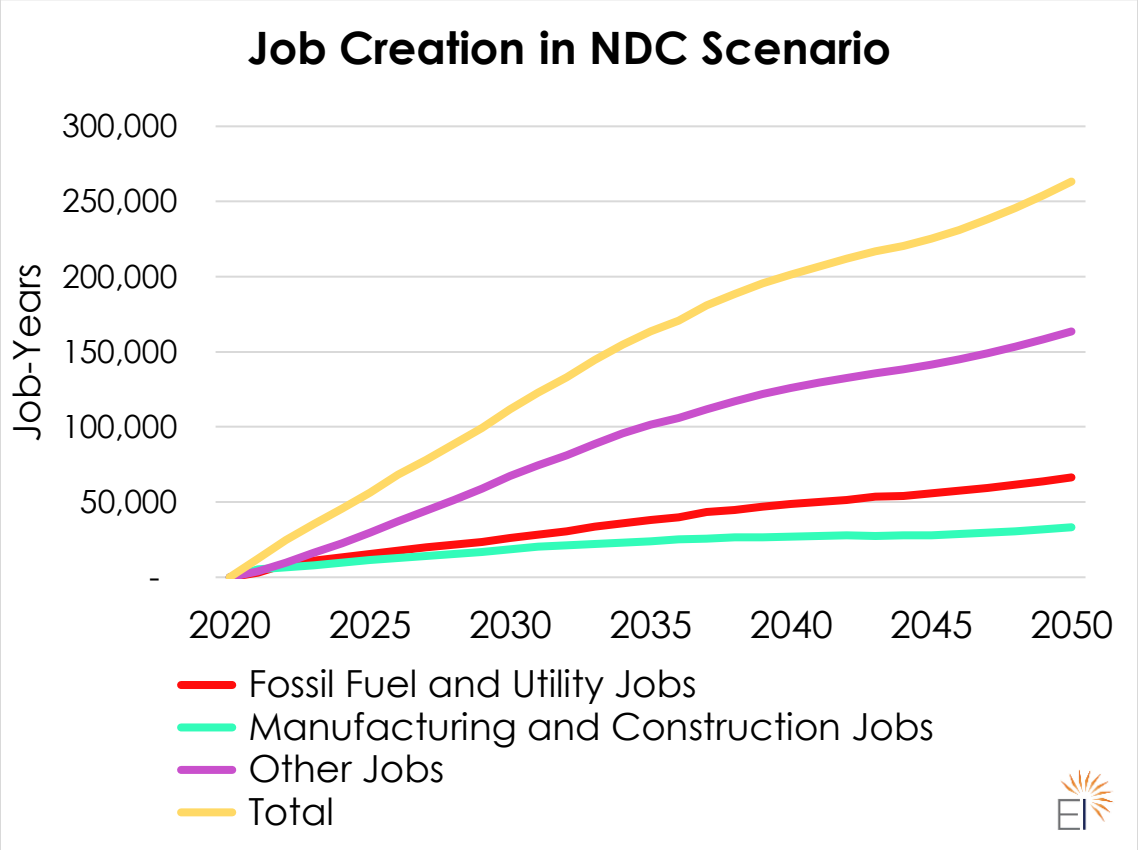
The NDC Scenario reduces Louisiana's projected net emissions (including land use) 36 percent below BAU in 2030 and 98 percent below BAU by 2050. The most effective measures simulated are industrial fuel switching (52 percent of NDC reductions by 2050), green hydrogen production (25 percent of NDC reductions by 2050), and a 100 percent clean electricity standard (7 percent of NDC reductions by 2050).

[xviii] See https://www.cogitatiopress.com/urbanplanning/article/view/1218; https://www.nature.com/articles/s41558-020-00921-7.

[xix] While not modeled explicitly in the Louisiana EPS, new buildings should also strive for low embodied carbon to reduce lifecycle emissions from construction.

JOBS AND HEALTH BENEFITS

The NDC Scenario includes installing new hydrogen equipment, solar projects, EV chargers, and other new infrastructure. The state-level input-output analysis embedded in the Louisiana EPS[xx] estimates that roughly 111,000 job-years can be added under this scenario in 2030 (see figure below) and 263,000 job-years can be added in 2050. Industrial fuel switching policies will create the most jobs of any policy.



Projected changes in jobs relative to BAU in the NDC Scenario[xxi]

[xx] Read more at https://energyinnovation.org/2020/10/19/united-states-eps-3-0-update-adds-gdp-and-jobs-impacts-improved-public-health-metrics-and-more/.

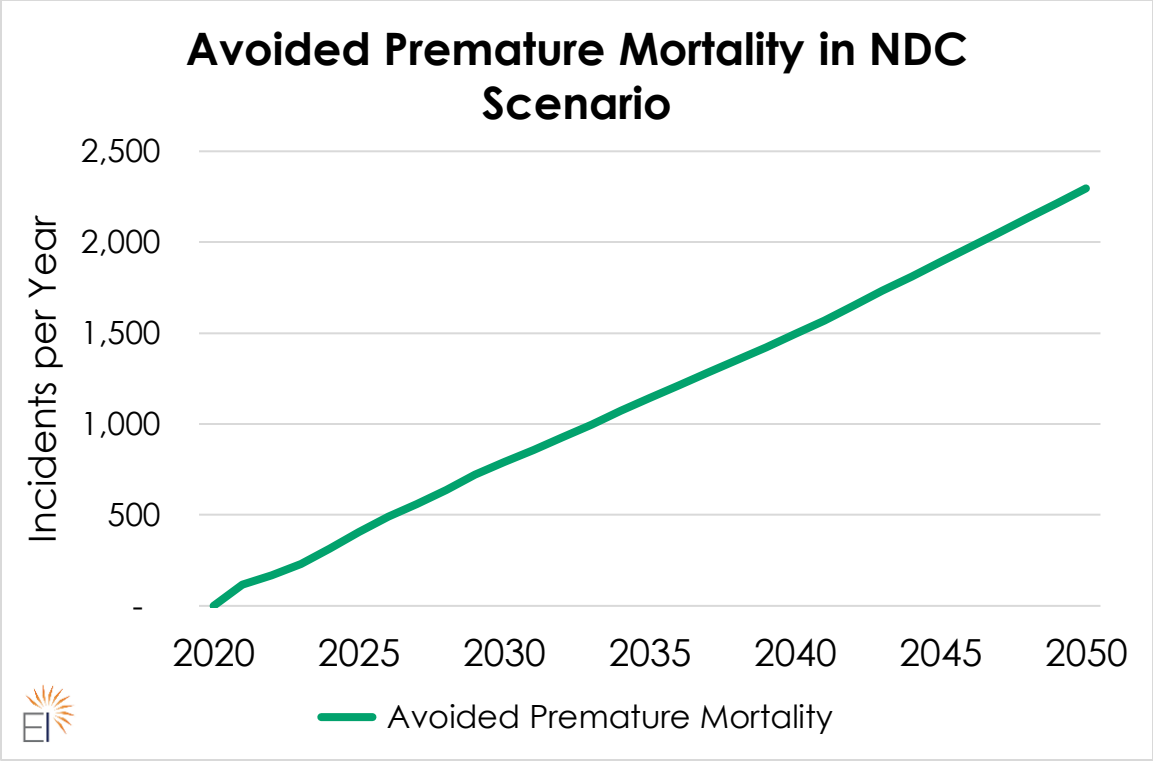
[xxi] Direct jobs are created in industries responsible for building clean energy infrastructure. Indirect jobs are created when products or services are demanded by these industries (e.g., electronic components manufactured within the state). Induced jobs are the result of net savings from a policy that can be recycled

Additional policies not modeled by the EPS would be necessary to ensure these newly created jobs benefit communities historically reliant upon, or affected by, the fossil fuel economy. For example, policies can support a sustainable, equitable, and just transition by considering impacted communities when siting new clean energy infrastructure projects. Policymakers can also create training programs to equip transitioning workers with the required skills, among other efforts. Social policies can provide for basic needs such as healthcare or financial assistance to ease the transition.[xxii]

The NDC Scenario shows emissions can be avoided in communities historically affected by pollution, resulting in improved public health. Fossil fuel power plant retirements, emissions-free building appliances, zero-emission on-road vehicles, and industrial fuel switching all reduce harmful particulate emissions and secondary atmospheric pollution created by burning fossil fuels.

into the local economy by households, firms, and the government (e.g., by reducing spending on imported petroleum and natural gas fuels, more money is available for local spending and investment).

[xxii] See National Academy of Sciences, 2021, Accelerating Decarbonization in the United States: A Comprehensive Policy Approach to a Just Transition.



Projected changes in premature mortality relative to BAU in the NDC Scenario

The Louisiana EPS, which includes a simple assessment of these benefits based on regional emissions factors by fuel and end use,[6] estimates that the NDC Scenario policies would prevent 800 deaths and 22,000 asthma attacks per year by 2030 and 2,300 deaths and 67,000 asthma attacks per year by 2050. These estimates were calculated using data from the U.S. Environmental Protection Agency (EPA) on the health incidents that occur or are avoided per ton pollutant.[xxiii] The EPS model calculates total changes in NOx, PM2.5, and SO_2 emissions between the BAU and NDC Scenarios and then calculates the avoided health incidents using U.S. EPA incident per ton pollutant values.[xxiv]

[xxiii] EPA values from U.S. Environmental Protection Agency, "Technical Support Document Estimating the Benefit per Ton of Reducing PM2.5 Precursors from 17 Sectors," February 2018, https://www.epa.gov/sites/default/files/2018-02/documents/sourceapportionmentbpttsd_2018.pdf.

[xxiv] More information on how public health inputs is calculated is available here: https://us.energypolicy.solutions/docs/additional-outputs.html.

CONCLUSION

Modeling with the Louisiana EPS tool can simulate policies that support the transition to clean energy and reduce Louisiana's contribution to climate change. In addition, the Louisiana EPS simulates how proposed policies could grow the state's economy and improve public health. Louisiana has a generational opportunity to become a national and global leader in clean industry and create the jobs of the future. The NDC Scenario provides a strong example of a strategic set of decarbonization policies that can rapidly reduce harmful emissions, while creating thousands of new jobs and adding billions to the state's economy every year.

NOTES

[1] Governor John Bel Edwards, *Executive Order Number JBE 2020 – 18,* August 2020, https://gov.louisiana.gov/assets/ExecutiveOrders/2020/JBE-2020-18-Climate-Initiatives-Task-Force.pdf.
[2] Energy Innovation, *A 1.5 Celsius Pathway to Climate Leadership for the United States,* 2021, https://energyinnovation.org/wp-content/uploads/2021/02/A-1.5-C-Pathway-to-Climate-Leadership-for-The-United-States.pdf.
[3] Smart Growth America and Transportation for America, *Driving Down Emissions Transportation, land use, and climate change,* 2020, https://t4america.org/wp-content/uploads/2020/10/Driving-Down-Emissions.pdf.
[4] Claire Mckenna, Amar Shah, and Mark Silberg, *It's Time to Incentivize Residential Heat Pumps,* June 8, 2020, https://rmi.org/its-time-to-incentivize-residential-heat-pumps/.
[5] Brady Seals and Andee Krasner, *Gas Stoves: Health and Air Quality Impacts and Solutions,* 2020, https://rmi.org/insight/gas-stoves-pollution-health/.
[6] U.S. Environmental Protection Agency, *Reduced-Form Tools for Calculating PM2.5 Benefits,* 2021, https://www.epa.gov/benmap/reduced-form-tools-calculating-pm25-benefits.